SYSTEMATIC EXAMINATION OF STARDUST BULBOUS TRACK WALL MATERIALS. K. Nakamura-Messenger[1,2], S.J. Clemett[1,2], A.N. Nguyen[1,2], E.L. Berger[1], L.P. Keller[1], S. Messenger[1]. [1]JETS, Houston, TX, [2]Robert M Walker Lab. Space Science, ARES, NASA/JSC, Houston, TX. keiko.nakamura-1@nasa.gov

Introduction: Analyses of Comet Wild-2 samples returned by NASA's Stardust spacecraft have focused primarily on terminal particles (TPs) or well-preserved fine-grained materials along the track walls [1,2]. However much of the collected material was melted and mixed intimately with the aerogel by the hypervelocity impact [3,4]. We are performing systematic examinations of entire Stardust tracks to establish the mineralogy and origins of all comet Wild 2 components [7,8]. This report focuses on coordinated analyses of indigenous crystalline and amorphous/melt cometary materials along the aerogel track walls, their interaction with aerogel during collection and comparisons with their TPs.

Experimental methods: A 1 mm^2 section was removed from the wall of aerogel Track#147 (4600 μm long with 7 TPs) and flattened with Mylar using techniques described in [7]. The samples were photo-documented using extended depth-of-field imaging to obtain the 3D particle distribution in the sample before and after flattening. The flattened pieces were subdivided, embedded in acrylic, and ultramicrotomed. Nanometer-scale quantitative compositional maps of samples in these microtome thin sections were obtained using a JEOL 2500SE 200 keV field-emission scanning-transmission electron microscope (STEM) equipped with energy-dispersive X-ray (EDX) spectrometer.

Results and Discussions: A total of 314 particles (1-20 μm) from 160 thin sections (70 nm thick) were systematically characterized. Of these, only ~4 % (15 grains, 100-800 nm in dia.) of the grains are crystalline, with the rest showing strong thermal alteration from interaction with molten aerogel. Altered grains typically consist of a vesicular, Si-rich glassy matrix with high density nanophase Fe-Ni-S inclusions [3,4]. Most of the rare crystalline grains are aggregates of polycrystalline olivine, pyroxene and amorphous Mg-Al-Na silicate, similar to the equilibrated aggregates (EAs) commonly observed in anhydrous chondritic porous interplanetary dust particles (CP-IDPs) [8-10]. We propose that the EA-like particles we observed are indigenous to Wild2 because they show limited to no contamination or interaction with aerogel.

Conclusions: Compared with our previous study of the TPs and grains from the wall cracks from the same cometary track #147 [4], the material within the track wall is dominated by melt, and crystalline survival is rare. In future work, NanoSIMS will be used for isotopic analyses on crystalline grains, and ultrafast two-step laser mass spectrometry (*ultra* L^2MS) will be used to investigate the nature and distribution of organic phases along the track wall and TPs.

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